

CLAIMS

1. A ride height control system for a suspension supporting an axle (136) carrying ground-engaging wheels relative to a vehicle and for maintaining a reference ride height of the vehicle relative to the ground, the suspension comprising
 - a height sensor (144) that senses the current vehicle ride height and
 - 5 generates and output signal representative of the current ride height;
 - an inflatable air bag (124) operably coupling the axle and the vehicle whereby the introduction and exhaustion of air to and from the air bag increases and decreases, respectively, the relative distance between the axle and the vehicle to adjust the vehicle ride height;
 - 10 a source of pressurized air (304) for use in inflating the air bag; and
 - a valve (116) for selectively fluidly coupling the air bag to the source of pressurized air or atmosphere to thereby introduce or exhaust air from the air bag, respectively; characterized by:
 - a valve actuator (222) coupled to the height sensor and to the valve
 - 15 wherein the valve actuator receives as input the height sensor output signal and selectively actuates the valve between a neutral position, where the air bag is not fluidly connected either to the source of pressurized air or to the atmosphere, a fill position, where the air bag is fluidly connected to the source of pressurized air to introduce air to the air bag, and an exhaust position, where the air bag is fluidly connected to atmosphere to exhaust air from the air bag, and thereby adjusts the ride
 - 20 height from the current ride height sensed by the height sensor to the reference ride height.
2. The ride height control system according to claim 1 wherein the valve actuator comprises a controller (240) that is programmed with control logic, wherein the controller uses the height sensor output signal in combination with the control logic to actuate the valve to adjust the ride height.
3. The ride height control system according to claim 2 wherein the valve actuator further comprises a motor (224) operably coupled to the controller and connected to the valve, whereby the controller actuates the motor to selectively actuate the valve.

4. The ride height control system according to claim 3 wherein the valve further comprises an inlet port (214) for connecting to the source of pressurized air, an air bag port (218) fluidly connected to the air bag, an exhaust port (220) connected to atmosphere, and a rotatable valve element (273) having a control passage (286) that 5 selectively fluidly connects the air bag port to the inlet port or the exhaust port upon rotation of the rotatable element.

5. The ride height control system according to claim 4 wherein the valve further comprises a valve housing (202, 304) defining an interior chamber (260) to which the inlet port, air bag port, and the exhaust port are fluidly connected.

6. The ride height control system according to claim 4 wherein the valve element fluidly separates the inlet port and the exhaust port.

7. The ride height control system according to claim 6 wherein the valve element is biased into sealing abutment against the valve housing by the pressurized air.

8. The ride height control system according to claim 7, wherein the housing comprises a first wall portion (262) from which extends a second wall portion (264) to partially define the interior chamber, the air bag port and the exhaust port being positioned on the first wall portion, and the inlet port being positioned on the 5 second wall portion, and wherein the rotatable valve element comprises a disk (273) having first and second opposing sides connected by a peripheral edge, the first side of the disk abutting the first wall portion and overlying the air bag port and the exhaust port and the second side facing the inlet port wherein pressurized air entering the inlet port biases the disk first side against the first wall portion to seal the air bag 10 port and exhaust port relative to the inlet port.

9. The ride height control system according to claim 8, and further comprising a static disk (272) positioned between the first wall portion and the rotatable disk and coupled to the first wall portion, the static disk having an exhaust passage (274) extending through the disk and in fluid communication with the exhaust 5 port and an air bag passage (276) extending through the static disk and in fluid communication with the air bag port.

10. The ride height control system according to claim 4 wherein the motor comprises an output gear (228) and the valve element comprises a transfer gear (230) coupled to the output gear wherein actuation of the motor rotates the output gear, which rotates the transfer gear to move the valve between the fill and exhaust positions.

11. The ride height control system according to claim 10 wherein the motor is reversible and the controller operates the motor in a first direction to move the valve into the fill position and in a second direction to move the valve into the exhaust position.

12. The ride height control system according to claim 11 wherein the sensor output signal is a voltage signal.

13. The ride height control system according to claim 12 wherein the voltage signal carries either a positive sign or a negative sign and the controller uses the sign of the voltage signal to determine the direction of operation of the motor.

14. The ride height control system according to claim 13 wherein the controller is programmed to maintain the vehicle ride height at the reference ride height.

15. The ride height control system according to claim 14 wherein the sign of the voltage signal is indicative of the vehicle being above or below the reference ride height.

16. The ride height control system according to claim 10 wherein the output gear is a worm gear.

17. The ride height control system according to claim 1 wherein the sensor is a transducer (144, 440, 540, 640, 740, 840, 940).

18. The ride height control system according to claim 17 wherein the transducer is a light sensor, variable-capacitance capacitor, or variable resistor.

19. The ride height control system according to claim 1 wherein the controller is programmed to maintain the vehicle ride height at the reference ride height.

20. The ride height control system according to claim 1 wherein the valve further comprises an inlet port (214) for connecting to the source of pressurized air, an air bag port (218) fluidly connected to the air bag, an exhaust port (220) connected to atmosphere, and a rotatable valve element (273) having a control passage (286) that 5 selectively fluidly connects the air bag port to the inlet port or to the exhaust port upon the rotation of the rotatable valve element.

21. The ride height control system according to claim 20 wherein the valve further comprises a valve housing (202, 304) defining an interior chamber (260) to which the inlet port, air bag port, and the exhaust port are fluidly connected.

22. An adjustable height suspension for a vehicle, comprising an axle (136) for carrying ground-engaging wheels and adapted to be moveably mounted to the vehicle;

5 a height sensor (144) that senses the current vehicle ride height and generates and output signal representative of the current ride height;

an inflatable air bag (124) operably coupling the axle and the vehicle whereby the introduction and exhaustion of air to and from the air bag increases and decreases, respectively, the relative distance between the axle and the vehicle to adjust the vehicle ride height;

10 a source of pressurized air (304) for use in inflating the air bag; and

a valve (116) for selectively fluidly coupling the air bag to the source of pressurized air or atmosphere to thereby introduce or exhaust air from the air bag, respectively; characterized by:

15 a valve actuator (222) coupled to the height sensor and the valve wherein the valve actuator receives as input the height sensor output signal and selectively actuates the valve between a neutral position, where the air bag is not connected to either the source of pressurized air or atmosphere, a fill position, where the air bag is connected to the source of pressurized air to introduce air to the air bag, and an exhaust position, where the air bag is connected to atmosphere to exhaust air

20 from the air bag and thereby adjust the ride height based on the current ride height sensed by the height sensor.

23. The suspension according to claim 22 wherein the valve further comprises an inlet port (214) for connecting to the source of air, an air bag port (218) fluidly connected to the air bag, an exhaust port (220) connected to atmosphere, and a rotatable valve element (273) having a control passage (286) that selectively fluidly connects the air bag port to the inlet port or to the exhaust port upon rotation of the rotatable valve element.
5

24. The suspension according to claim 23 wherein the valve further comprises a valve housing (202, 304) defining an interior chamber (260) to which the inlet port, air bag port, and the exhaust port are fluidly connected.

25. The suspension according to claim 22 wherein the valve actuator comprises a controller (240) that is programmed with control logic, wherein the controller uses the height sensor output signal in combination with the control logic to actuate the valve to adjust the ride height.

26. The suspension according to claim 25 wherein the valve actuator further comprises a motor (224) operably coupled to the controller and connected to the valve, whereby the controller actuates the motor to selectively actuate the valve.

27. The ride height adjustment system according to claim 26 wherein the motor comprises an output gear (228) and the valve element comprises a transfer gear (230) coupled to the output gear wherein actuation of the motor rotates the output gear, which rotates the transfer gear to move the valve between the fill and exhaust positions.
5

28. The suspension according to claim 27 wherein the motor is reversible and the controller operates the motor in a first direction to move the valve into the fill position and in a second direction to move the valve into the exhaust position.

29. The suspension according to claim 28 wherein the sensor output signal is a voltage signal.

30. The suspension according to claim 29 wherein the voltage signal carries either a positive sign or a negative sign and the controller uses the sign of the voltage signal to determine the direction of operation of the motor.

31. The suspension according to claim 30 wherein the controller is programmed to maintain the vehicle ride height at a predetermined height.

32. The suspension according to claim 31 wherein the sign of the voltage signal is indicative of the vehicle being above or below the predetermined height.

33. The suspension according to claim 32 wherein the output gear is a worm gear.

34. The suspension according to claim 33 wherein the sensor is a transducer (144, 440, 540, 640, 740, 840, 940).

35. The suspension according to claim 34 wherein the transducer is a light sensor, variable-capacitance capacitor, or variable resistor.

36. The suspension according to claim 22 wherein the controller is programmed to maintain the vehicle ride height at a predetermined height.

37. The suspension according to claim 22 wherein the suspension is a trailing arm suspension comprising a trailing arm (118) pivotally mounted to the vehicle and carrying the axle, and the air bag is an air spring (124) positioned between the trailing arm and the vehicle for relatively moving the trailing arm to the vehicle by the inflation or deflation of the air spring.